Fungicide performance update for wheat, barley and oilseed rape

Release date: 6 December 2017 (at the AHDB Agronomists’ Conference)
Note: These slides contain curves up to 100 per cent label dose.

The curves are different to those displayed on the screen at the AHDB Agronomists’ Conference, which showed results up to 200 per cent label dose. The data used to produce the curves is the same.
Fungicide performance update for wheat
## Wheat trial sites in harvest year 2017

<table>
<thead>
<tr>
<th>Site (organisation)</th>
<th>Target disease</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosemaund (ADAS)</td>
<td>Septoria tritici</td>
<td>Santiago</td>
</tr>
<tr>
<td>Sutton Scotney (NIAB)</td>
<td>Septoria tritici (double trial)</td>
<td>Dickens</td>
</tr>
<tr>
<td>Fife (SRUC)</td>
<td>Septoria tritici (double trial)</td>
<td>Consort</td>
</tr>
<tr>
<td>Cardigan (ADAS)</td>
<td>Septoria tritici</td>
<td>KWS Santiago</td>
</tr>
<tr>
<td>Carlow (TEAGASC)</td>
<td>Septoria tritici</td>
<td>KWS Lumos</td>
</tr>
<tr>
<td>Terrington (ADAS)</td>
<td>Yellow rust</td>
<td>Reflection</td>
</tr>
<tr>
<td>Cambridge (NIAB)</td>
<td>Brown rust</td>
<td>Crusoe</td>
</tr>
<tr>
<td>Gleadthorpe (ADAS)</td>
<td>Fusarium</td>
<td>Grafton</td>
</tr>
</tbody>
</table>
## Wheat septoria data 2017

<table>
<thead>
<tr>
<th>Site and timing</th>
<th>Target leaf</th>
<th>Protectant</th>
<th>Eradicant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosemaund T2</td>
<td>Flag</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sutton Scotney T1</td>
<td>Leaf 3</td>
<td></td>
<td>(brown rust)</td>
</tr>
<tr>
<td>Sutton Scotney T2</td>
<td>Flag</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fife T1</td>
<td>Leaf 3</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Fife T2</td>
<td>Flag</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Cardigan T2</td>
<td>Flag</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Carlow GS33</td>
<td>Leaf 2</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
## Wheat septoria products 2017

<table>
<thead>
<tr>
<th>Product</th>
<th>Active(s)</th>
<th>UK sites</th>
<th>Carlow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bravo</td>
<td>chlorothalonil</td>
<td>✓*</td>
<td>✓*</td>
</tr>
<tr>
<td>Ignite**</td>
<td>epoxiconazole</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Proline</td>
<td>prothioconazole</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Imtrex</td>
<td>fluxapyroxad</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Vertisan</td>
<td>penthiopyrad</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Elatus Era</td>
<td>benzovindiflupyr + prothioconazole</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Librax</td>
<td>fluxapyroxad + metconazole</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Ascra Xpro</td>
<td>bixafen + fluopyram + prothioconazole</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Bravo at 50% dose only  **Or ‘Bassoon EC’
Fungicide performance trials
>Since 1994
>Wheat trial locations

- Septoria tritici
- Yellow rust
- Brown rust
- Fusarium
Trial methods

• Each trial is sprayed just once
• Four rates of application tested
  • 25%, 50%, 100%, and 200% of full label rate per fungicide, plus untreated

Activity observed on each leaf layer and categorised as:

• Eradicant
  • If a leaf emerged before fungicides were applied

• Protectant
  • If a leaf had just emerged or was still emerging when fungicides were applied
Elatus Era

- Registered for use in January 2017
- Contains a new SDHI active, plus a triazole
  - 75 g/l benzovindiflupyr (Solatenol), plus 150 g/l prothioconazole
- Full label dose 1.0 l/ha
- Maximum one application
- Approved for use in wheat and barley
- In fungicide performance trials since 2016
Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Septoria protection 2015/16/17 (over trial)

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Septoria curative activity 2017 (n-3)

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Septoria curative 2015/16/17 (over trial)

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Septoria yields 2017 (n-5)

Use Imtex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Septoria trial yield 2015/16/17 (over trial)

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Rusts in 2017

June conditions

• Checked yellow rust development
• Promoted brown rust

75% of varieties have a RL disease rating of 6 or less for yellow or brown rust

Most susceptible:

• Yellow rust – Reflection, Cordiale, Gallant, JB Diego, Grafton and Skyfall
• Brown rust – Crusoe, Zulu, Savello and Shabras
Brown rust 2017 (inoculated)

Use Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Yellow rust 2017

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Yellow rust efficacy
Three-year mean (2015 to 2017)

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Yellow rust trial yields
Three-year mean (2015 to 2017)

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Fusarium 2017

Percentage of full label rate

% ears infected

Proline
Ignite
Caramba 90
Folicur
Fusarium efficacy
Three-year mean (2015 to 2017)
Fusarium DNA and mycotoxins (2015 to 2017)

Doughnut chart showing DON ppb levels for different treatments:
- Caramba 90
- Folicur
- Ignite
- Proline275
- Untreated (highest)

Bar chart showing Fusarium DNA (pg/ng) levels for different treatments:
- Caramba 90
- Folicur
- Ignite
- Proline275
- Untreated (highest)
Azole: septoria activity (full dose)

**Protectant**

- Prothioconazole
- Epoxiconazole

% Variance accounted for = 65.6

Mean value for all sites in fungicide performance trials in each year for percentage control (2001 to 2017)

**Curative**

- Prothioconazole
- Epoxiconazole

% Variance accounted for = 65.7
SDHIs (Imtrex): septoria tritici control (2013 to 2017, protectant situations)

Bold lines show the mean response in each year.
Dotted lines show the highest and lowest percentage control achieved.
SDHIs (Vertisan): septoria tritici control (2013 to 2017, protectant situations)

Bold lines show the mean response in each year. Dotted lines show the highest and lowest percentage control achieved.
Are we selecting for less sensitivity? (2017 treatments in FP trials)

SDHI sensitivity (post treatment application)

Single AHDB site from 2017 (SDHI = bixafen. Data courtesy of Bart Fraaije, Rothamsted Research)
Septoria sensitivity to SDHIs (lab tests) (early spring 2017)

Data courtesy of Bart Fraaije, Rothamsted Research. SDHI = bixafen
SDHI sensitivity (laboratory)
Ireland 2011 to 2017

Data courtesy of S. Kildea, Teagasc
Fungicide performance for wheat summary

• Septoria tritici
  • SDHIs highly active but some evidence of decline in efficacy
  • Elatus Era, Librax and Ascra comparable for protection
  • Use azoles and multisites to slow resistance development

• Rusts
  • Epoxiconazole highly effective in curative situations
  • Pyraclostrobin showed good activity (especially on yellow rust)
  • New SDHI Elatus Era, highly effective on yellow and brown rust

• Fusarium
  • Prothioconazole leads. Metconazole, tebuconazole, and epoxiconazole are all close behind
Fungicide performance update for barley
Barley targets and sites in harvest year 2017

<table>
<thead>
<tr>
<th>Target disease</th>
<th>Sites</th>
<th>Number of trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powdery mildew</td>
<td>Midlothian</td>
<td>1</td>
</tr>
<tr>
<td>Rhynchosporium</td>
<td>Lanark, Carlow, and Cardigan</td>
<td>3</td>
</tr>
<tr>
<td>Net blotch</td>
<td>Norfolk and East Yorkshire</td>
<td>2</td>
</tr>
<tr>
<td>Ramularia</td>
<td>Scotland</td>
<td>1</td>
</tr>
</tbody>
</table>
Rhynchosporium protection 2017 (n=2)

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Rhynchosporium protectant data (2015 to 2017)

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
QoI (strobilurin) efficacy on rhynchosporium (2001 to 2017)

Data based on efficacy of Comet (pyraclostrobin)
Previously on ramularia: 2011 to 2015 (n=3)

Use Imtrex and Zulu only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Ramularia 2017 (single site)

Midlothian 2017 (mean of two leaves)

Use Imtrex, Vertisan and Zulu only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
SRUC Ramularia - additional trial (Scotland)

Note: All fitted lines are the same except bravo.
Net blotch 2017 (two sites)

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Net blotch: changes in protectant activity (single active products)

2014+2015 trials (n=2)
- Proline
- Comet
- Imtrex
- Zulu
- Vertisan

Use Imtrex, Vertisan and Zulu only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.

2016+2017 trials (n=3)
- Proline
- Comet
- Imtrex
- Zulu
- Vertisan

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Net blotch: changes in protectant activity (mixtures)

2014+2015 trials (n-2)

2016+2017 trials (n-3)
Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Fungicide performance for barley summary

Rhynchosporium:
  • Excellent control from Proline or Imtrex alone or in mixes (Priaxor, Elatus Era and Siltra)
  • Trend for a decline in activity of Comet observed

Net blotch:
  • Reduced sensitivity to SDHIs now confirmed
  • Mixture products gave best efficacy
  • Comet still adds usefully to efficacy

Ramularia:
  • Chlorothalonil (alone or in mixtures) still effective
  • Little field efficacy of SDHI and azoles in 2017 trials

Mildew:
  • Prothiocanazole effective (alone or in mixtures), as was Cyflamid. SDHIs add to efficacy
## Modes of action and efficacy

<table>
<thead>
<tr>
<th></th>
<th>Rhynchosporium</th>
<th>Net blotch</th>
<th>Ramularia</th>
<th>Powdery mildew</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Azoles</strong></td>
<td>✓</td>
<td>✓</td>
<td>Insensitive isolates in UK populations</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Strobilurins</strong></td>
<td>Insensitivity?</td>
<td>Partial Insensitivity (F129L)</td>
<td>Insensitivity (G143A)</td>
<td></td>
</tr>
<tr>
<td><strong>SDHIs</strong></td>
<td>✓</td>
<td>Insensitive isolates in UK populations</td>
<td>Insensitive isolates in UK populations</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Multisites</strong></td>
<td>✓</td>
<td>-</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
Fungicide performance update for oilseed rape
## Trial sites in harvest year 2017

<table>
<thead>
<tr>
<th>Target disease</th>
<th>Site</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phoma</strong> (two sprays*)</td>
<td>Norfolk</td>
<td>ADAS</td>
</tr>
<tr>
<td></td>
<td>Herefordshire</td>
<td>ADAS</td>
</tr>
<tr>
<td><strong>Light Leaf Spot</strong> (two sprays**)</td>
<td>North Yorkshire</td>
<td>ADAS</td>
</tr>
<tr>
<td></td>
<td>Dorset</td>
<td>NIAB</td>
</tr>
<tr>
<td></td>
<td>Midlothian</td>
<td>SRUC</td>
</tr>
<tr>
<td><strong>Sclerotinia Stem Rot</strong> (single spray***)</td>
<td>Herefordshire</td>
<td>ADAS</td>
</tr>
<tr>
<td></td>
<td>Ceredigion</td>
<td>ADAS</td>
</tr>
</tbody>
</table>

*10 to 20 per cent of plants affected, followed by 4 to 10 weeks (when reinfection evident)

** Autumn (November/December) overspray, followed by pre/early stem extension application (February to March)

***early to mid-flowering application
## Products included in trials in 2017

<table>
<thead>
<tr>
<th>Product</th>
<th>Active(s)</th>
<th>Full dose (l/ha)</th>
<th>Phoma</th>
<th>Light leaf spot</th>
<th>Sclerotinia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Proline 275</td>
<td>prothioconazole</td>
<td>0.63</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Refinzar&lt;sup&gt;a&lt;/sup&gt;</td>
<td>pendiopyrad + picoxystrobin</td>
<td>1.0</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Pictor&lt;sup&gt;a&lt;/sup&gt;</td>
<td>dimoxystrobin + boscalid</td>
<td>0.5</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Filan</td>
<td>boscalid</td>
<td>0.5 (kg/ha)</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Amistar</td>
<td>azoxystrobin</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

+ = included in trials; - = not included in trials
<sup>a</sup> = used as autumn or two-spray programme to fit experimental protocol (restrictions on label)

**Note:** Products near to market are tested but data cannot be released until after registration.
Phoma leaf spot/stem canker
Phoma leaf spot progress (Norfolk)

September to November 2017

- Arrow = date and percentage of plants in the OSR crop with phoma leaf spot

September to November 2016

Source: DuPont, University of Hertfordshire, Hutchinsons
Stem canker 2017 (Norfolk)
Stem canker and yield 2016 (Norfolk)
Phoma leaf spot/stem canker (summary)

Season so far
• Early onset of the epidemic
• Thresholds met in late September/early October in some areas
• Reinfection occurred 4 to 6 weeks after first sprays

Fungicide efficacy
• Azole and non-azole products have activity
• Two applications in the autumn providing effective control
• No reports of resistance to fungicides

Outlook: 2017/2018
• Fungicide programmes up to date
• May see more stem canker pre-harvest in some crops
Light leaf spot
Light leaf spot: Lowest levels in the spring in England since 2008

cropmonitor.co.uk
Source: Defra winter oilseed rape disease surveys
Light leaf spot trials in 2017:
Disease control and fungicide application timing (across 3 sites)*

*Overspray applied in November 2016 and stem extension treatments applied in early March 2017, typically at GS30 (rosette stage: beginning of stem extension)
Significant yield increase with the November fungicide overspray (across 3 sites)

Pre/at stem extension sprays reduced stem and pod disease severity

*Overspray applied in November 2016 and stem extension treatments applied in early March 2017, typically at GS30 (rosette stage: beginning of stem extension)
Light leaf spot trials: Summary for 2017

• November sprays were important for light leaf spot control at the trial sites

• Spring epidemic was not as severe as previous years, which was unusual

• Both November and later applications (before or at stem extension) are important for good control

• Later applications reduced stem and pod disease severity
Light leaf spot control across years – 5 trials in 2015 and 2016*

*Orius P in harvest year 2015 only, all other products in both years
Light leaf spot (summary)

Season so far
- Earlier-sown crops more at risk
- Lesions reported on incubated samples in November

Fungicide efficacy
- Both azole and non-azole products provide control in the trials
- Anti-resistance management strategies
- Scottish sites – yield benefits with higher doses

Outlook: 2017/2018
- Regional and local risk
- Monitor crops in new year and treat promptly, if symptoms seen
Sclerotinia stem rot
Yellow line = duration of flowering
Red points = Sklero Pro infection events
Blue bars = rainfall (mm)
Arrow = fungicide application date (14 April)
Sclerotinia disease and yield: Ceredigion 2017

![Graph 1: Sclerotinia index vs. Percentage of full label dose]

- Sclerotinia index is plotted against the percentage of the full label dose on the x-axis.
- The y-axis represents the sclerotinia index ranging from 0 to 7.

![Graph 2: Yield (t/ha) vs. Percentage of full label dose]

- Yield (t/ha) is plotted against the percentage of the full label dose on the x-axis.
- The y-axis represents the yield ranging from 0 to 4.

- Red line represents Proline 275.

The graphs illustrate the relationship between the percentage of the full label dose and both the sclerotinia index and yield.
Sclerotinia risk: Herefordshire in 2017

Yellow line = duration of flowering
Red points = Sklero Pro infection events
Blue bars = rainfall (mm)
Arrow = fungicide application date (14 April)
Sclerotinia disease and yield: Rosemaund 2017

![Graph showing Sclerotinia index and yield from 0% to 100% of full label dose.](image)

- **Sclerotinia index**
  - Y-axis: Sclerotinia index
  - X-axis: Percentage of full label dose
  - Data points for Proline 275, Amistar, and Filan are shown.

- **Yield (t/ha)**
  - Y-axis: Yield (t/ha)
  - X-axis: Percentage of full label dose
  - Data points for Proline 275, Amistar, and Filan are shown.
Performance of sclerotinia fungicides across 5 sites (2015 to 2017)

Cross site analysis: 5 sites 2015 to 2017
Sclerotinia stem rot (summary)

Season so far
- Infection risk dependent on weather during flowering
- On-farm history can increase risk

Fungicide efficacy
- Higher doses (75% of label dose and above) provide 3 weeks protection
- Range of active ingredients available
- No resistance to sclerotinia fungicides reported in UK

Outlook: 2017/2018
- Data available on efficacy of other products from previous projects
- Fungicides protectant activity only
- Application timing important for good control
Efficacy is in your hands...

**Fungicide Futures** combines anti-resistance management information with the power of AHDB’s communications channels...

[cereals.ahdb.org.uk/fungicidefutures](cereals.ahdb.org.uk/fungicidefutures)

Fungicide Futures is a joint initiative between AHDB and the Fungicide Resistance Action Group UK (FRAG)
Arable Connections: Winter

Bringing farmers, agronomists, processors and researchers together to share better ways of working.
cereals.ahdb.org.uk/events

**Agronomy 2018**
A series of free indoor events exploring technical developments and ways to improve farming businesses.

Scotland – 9, 11, 16 and 18 January 2018
East Midlands – 23 January 2018
East Anglia – 6 February 2018
Wales – 7 February 2018
West – 8 February 2018
North – 13 February 2018
South East – 15 February 2018
South West – 21 February 2018

**Milling Wheat Conference**
A conference focused on achieving excellence in the milling wheat market
*In association with nabim. Incorporating the YEN Wheat Quality Award.*

Cambridgeshire – 1 March 2018

**United Oilseeds/AHDB Joint Seminar**
An opportunity to talk about the factors affecting establishment, cultivation and profitability of oilseed rape.

Newbury – 8 February 2018
‘Inspiring our farmers, growers and industry to succeed in a rapidly changing world’